Holding Pens Hold *Salmonella* Too

It's common for pigs to wait in holding pens for at least 2 hours after transport, before slaughter. It's a matter of meat quality: Loading, unloading, and travel stress lead to lactic acid buildup in pigs' muscles that, if not given a chance to dissipate, can affect meat quality, texture, and color.

But ARS and Iowa State University (ISU) research shows this respite can significantly increase the pigs' chance of being exposed to *Salmonella* bacteria. "We found up to a 10-fold increase in the number of pigs that tested positive for *Salmonella* infection at slaughter versus those tested on the farm," says veterinary epidemiologist H. Scott Hurd. He led these studies for the ARS National Animal Disease Center (NADC) in Ames, Iowa, in collaboration with ISU veterinarian James McKean.

Hurd, of NADC's Pre-Harvest Food Safety and Enteric Diseases Unit, says on-farm infection rates generally range from 4 to 7 percent. "But we've found that the rate of infection among the pigs increases to nearly 40 percent once they've spent just a few hours in the holding pen," he says. This phenomenon is occurring in both large and small processing plants.

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During early morning hours, veterinary epidemiologist H. Scott Hurd (right) and veterinarian Marcos Rostagno unload pigs from a barn and lead them to a trailer that will transport them to slaughter.

Just a Short Wait Can Do It

One of these studies showed infection occurring in as little as one-half hour of exposure. In another, all hogs were contaminated after 6 hours of exposure. "The significance of this is that it's a newly recognized control point," he says. "The question is: what can be done about it?"

The Centers for Disease Control and Prevention in Atlanta reports *Salmonella* bacteria sicken about 40,000 Americans—and kill about 1,000—each year.

"Most researchers are focusing on the *Salmonella* germ itself," Hurd says. "We're looking at the whole process of pig production and harvest and how it affects *Salmonella* levels." In addition to documenting the jump in infection rates inside the holding pen, the two researchers are examining ways to prevent the bacteria's spread.

"Moisture that is prevalent in the holding pens, coupled with the pigs' inherent nature to explore their new surroundings by roaming and snorting around, are the likely culprits that increase the rate of *Salmonella* exposure," Hurd says. While there is not much that can be done about the pigs' inquisitive nature, Hurd sees limiting moisture in the holding pens as one of the keys to reducing the infection rate.

One way of accomplishing this is by replacing the concrete floors now common in holding pens with slatted ones. "This would allow for channeling most of the slurry in the pens off into pits," he says. "Without the slurry, there are fewer organisms to pick up." Another way is to find an alternative to cooling the animals off with sprinklers. Cleaning and disinfecting the holding pens between occupancy by groups of pigs might also be effective.

Hurd says that moving the pigs directly from transport trucks to slaughter can be considered, although it would require careful handling during unloading to avoid lactic acid buildup.

A Diet-Based Solution?

The two scientists, along with ISU researcher Ron Griffith, have also studied a dietary solution: fructooligosaccharide (FOS), a nondigestible, soluble-fiber carbohydrate that supports growth of beneficial bacteria.

"We wanted to see whether adding FOS to the diet of swine before slaughter would decrease the number of *Salmonella* present in the intestinal contents and tissues at slaughter," says Hurd. "The carbohydrate has been shown to enhance the growth of intestinal lactic acid bacteria which, in turn, helps prevent colonization with a variety of pathogenic bacteria, including *Salmonella*."

In an experiment, Hurd, McKean, and Griffith gave 48 market-weight swine water containing 0.75 percent FOS for 4 days and then exposed them to *Salmonella* bacteria on the floor, as occurs in the holding pens.

Postslaughter examination revealed no differences in the number of positive samples in the intestines of pigs receiving FOS and the controls. "But the infection rates of intestinal lymph nodes were decreased in those pigs receiving FOS in their diets," says Hurd. "That is a positive result we may be able to build on."

"Anything that will further diminish the chances of foodborne contamination is a great boon. Today's pork industry is very concerned about food safety. Making pork safer will attract health-conscious consumers in the United States and in foreign markets."**—H. Scott Hurd**

The overall research—funded by ARS, the National Pork Producers Council, and the Food Safety Consortium of Iowa State and Kansas State universities and the University of Arkansas—comprised six separate studies necessitating many hours away from the laboratory by Hurd and McKean.

"Most of the research has been real work on real farms and in real packing plants," says Hurd. "That's unique within animal disease research. We were right there, working with the producers and packers."

Hurd says there are processes that keep most *Salmonella* from reaching pork consumers. "A lot of *Salmonella* is cleaned up along the way," he says. "And proper preparation and cooking act as the final steps to this.

"But anything that will further diminish the chances of foodborne contamination is a great boon," he says. "Today's pork industry is very concerned about food safety. Making pork safer will attract health-conscious consumers in the United States and in foreign markets."—By **Luis Pons,** ARS.

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At the slaughterhouse, Marcos Rostagno places a gauze pad on the holding pen floor as soon as study pigs are unloaded. The gauze sample will be cultured for *Salmonella* bacteria.